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Orchiectomy in the European brown bear

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ABSTRACT

Facilities for captive holding of European brown bears (*Ursus arctos*) are usually limited in capacity and already filled. The brown bear is a protected species, reduction of free-living population is not allowed and protection of existing numbers is requested by international conventions. The best regulation of population in captivity is by orchiectomy because of surgical simplicity and efficiency. We achieved general anaesthesia by use of a combination of ketamine hydrochloride and xylazine hydrochloride applied intramuscularly in four treated males. Surgical procedure of orchiectomy was carried out by closed method using two skin incisions parallel to raphe scroti in one bear and prescrotal incision in the remaining 3 bears. Spermatic cord was ligated by a triple clamp technique. Skin incisions were sutured by simple interrupted pattern with absorbable suture material. Recovery from general anaesthesia was without side-effects after a mean duration of 172 min. Mean surgery time was 54 min. The surgical wounds healed "per primam".

Key words: brown bear, *Ursus arctos*, testicle, orchiectomy, castration

Introduction

The European brown bear (*Ursus arctos*) is listed in Appendix II of the Berne Convention, in which strictly protected fauna species are specified. It is also listed in the Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as a potentially endangered species (SWENSON et al., 2000). The Croatian Red Book of mammals also lists the brown bear (DRAGANOVIĆ, 1994). All of these indicate that in nature the species is in relatively low numbers and that optimal reproduction is desired. However, the facilities for captive holding generally have enough brown bears and their release back to nature is not possible. Euthanasia of surplus bears is

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not acceptable to the general public and therefore control of their reproduction is highly desirable. Separation of bears by sex is often not possible due to enclosure limitations. Hormonal implants show negative side-effects after prolonged use. Surgical castration seems to be one of the preferable choices. It also helps to make a bear less aggressive, so more individuals may be kept together, or handling is easier in the case of pet-type bears.

Methods of bear orchiectomy are poorly described in the literature. The anatomy of the male reproductive system in brown bear is not well known. It is usually compared to the reproductive system of domestic carnivores, usually with that in dog, which is well described.

Castration or neutering refers to surgical removal of either testicles (orchiectomy) or ovaries with uterus (ovariohysterectomy) (FOSSUM, 1997). Although the term "orchiectomy" is used in male animals (FOSSUM, 1997; CRANE, 1998; BOOTHE, 2003), the term "castration" is still used for surgical removal of testicles (BERGE and WESTHUES, 1966; DIETZ et al., 1981; FOSSUM, 1997; CRANE, 1998; BOOTHE, 2003). DIETZ et al. (1981) used also use the term "sterilisation" for surgical removal of testicles.

Orchiectomy can be performed by open or closed fascia spermatica externa. Both methods use a midline pre-scrotal skin incision made cranially from the scrotum. "Closed" orchiectomy is performed by pushing testicles cranially through the skin incision. Subcutaneous tissue and spermatic fascia are incised over the testicle to expose it and to release scrotal ligament. Fascia and fat tissue around fascia spermatica externa are released by gauze sponge until testicles and spermatic cord become visible. "Opened" orchiectomy is performed by incision through the parietal vaginal tunic which covers the spermatic cord where two ligatures are to be placed. Parietal vaginal tunic and cremaster muscle are ligated by circumferential (non-transfixing) or transfixing ligatures distal to spermatic cord ligation. Parietal vaginal tunic can be incised before the exteriorization of testicles. Tunic should be separated from spermatic cord; those two structures should be ligated doubly and separately. The "Closed" method is performed in such a manner that spermatic cord and vaginal tunic are doubly ligated by transfixing ligation. The needle passes through spermatic cord, then transects and returns to the inguinal region. If necessary, the subcutis is closed with absorbable suture material. The skin is closed with an intradermal absorbable suture material (FOSSUM, 1997; BOOTHE, 2003). Scrotal ablation is recommended whenever trauma to the scrotum is severe, and in dogs with pendulous scrotum and neoplasia. The procedure is the same as described above (FOSSUM, 1997; BOOTHE, 2003).

DIETZ et al. (1981) have described orchiectomy in the dog by closed tunica in two anatomy regions. They have used a method of two skin incisions parallel to raphae scroti and two incisions in the inguinal region. BERGE and WESTHUES (1966) have also

described a method with two incisions parallel to raphae scroti. The difference in the last method is that incisions are made on the cranial part of the scrotum. CRANE (1998) has also described orchiectomy in dog by open and closed tunics, where in the closed method three haemostatic clamps were placed on processus vaginalis and m. cremaster (triple-clamp technique).

Orchiectomy in three European brown bears in captivity was described by LEDECKÝ et al. (2003). The Closed method was used, two skin incisions parallel to raphae scroti were made. On both spermatic cords two transfixing ligations were placed by Dexon® (Davis-Geck)**,** incision wounds were not sutured and were rinsed with antibiotic solution.

We describe our experience with four male brown bear castrations. The object was to provide a relevant published source for this procedure and to help in approaching eventual standardization of bear orchiectomy

Materials and methods

A total of 4 male European brown bears underwent the orchiectomy procedure (Table 1). The Closed method of orchiectomy was used in all four bears. In bear No. 1 orchiectomy was done by the method of two skin incisions parallel to raphae scroti made on the most ventral position of scrotum, whereas in bears 2, 3 and 4 orchiectomy was performed by pre-scrotal incision.

Table 1. Identification data of treated male European brown bears

Nº	Bear ID	Date of surgery	Location	Age (months)	Body mass (kg)
1	Kenny	20 March 1993	Villach, Austria	14	113
2	Mrnjo	21 April 2004	Kuterevo, Croatia	27	84
3	Ljubo	18 April 2005	Kuterevo, Croatia	27	85
4	Zdravko	18 April 2005	Kuterevo, Croatia	27	115

General anaesthesia was achieved by a combination of ketamine hydrochloride (Ketalar®, Parke-Davis, Pontypool Mon., Wales; Ketamine hydrochloride®, Rotexmedica, Trittau, Germany) and xylazine hydrochloride (Rompun®, "BAYER", Leverkusen, Germany). Anaesthetics were applied in a projectile syringe by gun or blowpipe, and eventual supplementary doses by hand. The route of administration was intramuscular (IM). Bear body mass was estimated before administration and the dose of anaesthetics was determined and applied on the basis of literature data. Duration of anaesthesia was adequate for the performed orchiectomy (HUBER et al., 1986; RADIŠIĆ, 2001).

Fig. 1. Surgical site in European brown bear framed with drapes

In general, anaesthetised bears were brought to the examination facility where their body mass and other measures were taken, blood samples collected and the surgery performed. The bear was positioned in dorsal recumbency. The scrotum in bears is anatomically divided by a midline into two equal parts (Fig. 1). Before the surgery, skin of the pre-scrotal and scrotal areas was shaved, scrubbed with soap solution and disinfected with 70% ethanol and iodine (7.5% and 10% solutions, respectively) (Fig. 1). A surgical site of 25x25 cm was defined with two sterile drapes covering the reminder of the bear (Fig. 1). Local anaesthetic (10 mL of Xylocain® "Schwer" 2%, Astra Chemicals GmbH, Germany) was applied subcutaneously in the scrotum of bear No. 1 and in both spermatic cords after skin incision was made. In bears 2, 3 and 4 medial a 6-8 cm-long skin incision was made cranially to the scrotum, without local anaesthetic application. Incision was made through the skin, subcutaneous fat tissue and both superficial and profound fascia of abdominal wall.

Exteriorization of left and right testicles exposed the spermatic cord on each side, and at the same time external spermatic fascia was preserved. Testicles were bluntly dissected from scrotum, lig. scroti was threaded by sterile gauze sponge and fat tissue, that fills the scrotum, was evacuated. Testicles were fixed using the method of triple haemostatic forceps (Fig. 2). One transfixing and one non-transfixing ligature was placed on both spermatic cords with absorbable multifilament suture material polyglactin 910 (Vicryl®, Ethicon), diameter 1 (United States Pharmacopoeia, USP). Transfixing ligature was placed between proximal and middle haemostatic forceps and was applied with a taper needle between m. cremaster and spermatic cord. We took special care to miss the vascular structures of the spermatic cord. The ligature was tied over the cremaster muscle, the ends of the suture were passed in the opposite direction back around the spermatic cord to encircle it, and finally completed the ligature by forming a knot. A second, non-

transfixing ligature was placed around middle clamp as it was slowly removed from sight. The ligatures were placed about 2 cm apart.

Testicles were transected at the proximal edge of distal clamp. The incision was rinsed with sterile saline. Subcutis was closed with a simple continuous Kirschner suture pattern, while the skin was closed with a simple interrupted suture (Fig. 3). In bear No. 1, skin incisions were sutured with a simple interrupted suture without closing the subcutaneous tissue (Fig. 4). Absorbable multifilament suture material polyglactin 910 (Vicryl®, Ethicon) diameter 1 USP was used to avoid subsequent removal of the stitches, which could not be done without immobilization.

Fig. 2. Orchiectomy of European brown bear with covered external spermatic fascia using the triple clamp technique

Passive immunization against *Clostridium tetani* toxin was achieved by application of a prophylactic dose of tetanus antitoxin (Tetanus antitoksin 300®, Veterina, Croatia) subcutaneously (SC) in plica geni to each bear. To prevent secondary infections Sulfapyridazin (Sulfapyridazin 25%, Veterina, Croatia) and a long-lasting antibiotic (Benzapen®, Veterina, Croatia) were administered IM.

After surgery, treated animals were returned to their enclosures. Bear No. 1 was alone; No. 2 had the company of a female bear that had not been immobilized, while the bears 3 and 4 were treated together. In the case of bear No. 2 the accompanying female did show some interest in the area of the surgical wound on the body of the sleeping male but did

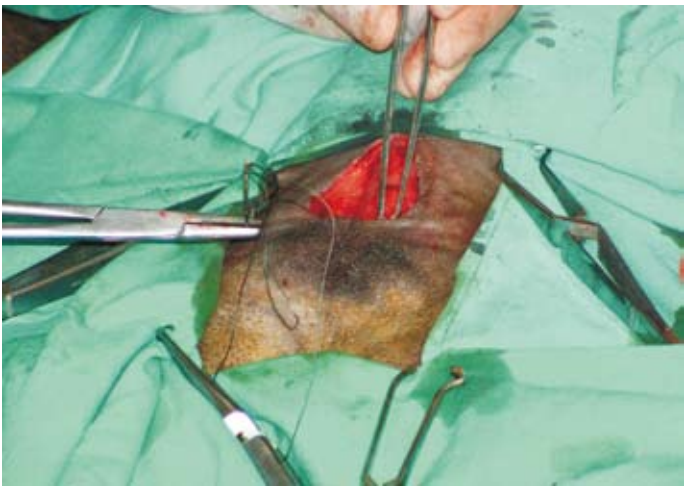

Fig. 3. Closing of prescrotal incision in European brown bear by absorbable suture material

Fig. 4. Two skin incisions in European brown bear N^{o} 1. parallel to raphae scroti closed by absorbable suture material

not disturb the wound. All bears behaved normally after recovering from anaesthesia and showed no side-effects.

Results and discussion

The procedure of bear handling for orchiectomy is shown in Table 2.

Table 2. Doses of used anaesthetics, duration of anaesthesia and orchiectomy

Bear N°	Total dose of xylazine hydrochloride (mg/kg bm)	Total dose of ketamine hydrochloride (mg/kg bm)	Duration of general anaesthesia (minutes)	Duration of orchiectomy (minutes)
1	4.16	5.04	228	80
2	7.74	7.74	194	58
3	5.29	4.71	104	30
4	6.96	11.34	160	48

For general anaesthesia mean doses of 5.62 mg/kg of body mass of xylazine hydrochloride and of 7.21 mg/kg of body mass ketamine hydrochloride were used for each bear. Doses of used anaesthetics were determined on the basis of the amount of used anaesthetics after body mass of immobilized bears had been measured, while the anaesthesia was achieved on the basis of estimated body mass. Mean total dose of anaesthetics applied was approximate to recommended doses (i.e. for ketamine 9.8 ± 5.6 mg/kg body mass, and for xylazine 5.5 ± 3.6 mg/kg body mass of bear; HUBER et al., 1986; RADIŠIĆ, 2001). The difference in ketamine dose can be explained by the more precise body mass estimated for bears living in captivity, as a result of frequent estimation of same animals and, consequently, lower doses of ketamine were necessary to achieve the same effect. LEDECKÝ et al. (2003) have also carried out orchiectomy in three male brown bears that were living in captivity, and where the general anaesthesia was also based on estimated body mass.

Duration of general anaesthesia was approximately 171.5 min., which was sufficient time to perform orchiectomy. Positioning the bear in dorsal recumbancy, orchiectomy itself, and returning in its enclosure took an average of approximately 54 min. RADIŠIĆ (2001) has described a duration of general anaesthesia of 154.9 ± 100 min., which was achieved in brown bears using the same anaesthetics.

LEDECKÝ et al. (2003) carried out orchiectomy on three bears by the method of two incisions parallel to raphae scroti made on the scrotum above the testicles when the bear

was in dorsal recumbancy. In this study, orchiectomy of bear No. 1 was done in the same manner as did LEDECKÝ et al. (2003), with the difference that we closed surgical wounds with a simple interrupted suture, while LEDECKÝ et al. (2003) left wounds open. Orchiectomy was performed with covered fascia spermatica externa, two transfixing ligations 1 cm apart were placed at a distance of 8 to 10 cm from testicles (LEDECKÝ et al., 2003), with absorbable polyglycolic acid (Dexon®, Davis-Geck). CRANE (1998) described orchiectomy using triple haemostatic forceps or the triple clamp method, which we also used in this study. In contrast to LEDECKÝ et al. (2003), we used one transfixing and one non-transfixing ligature and absorbable polyglactin 910 (Vicryl®, Ethicon), diameter 1 USP with ligatures placed 2 cm apart at distance of 10 cm from testicles.

LEDECKÝ et al. (2003) applied NSAID and flushed the wound after surgery with an antibiotic solution, which we did not do because we closed the wound and applied long-lasting antibiotics and passive immunisation against *C. tetani* intoxication.

During castration there were no side-effects, such as painful reaction and resistance to manipulation. All animals survived the surgery, waking up was as normal. Daily monitoring of bears has shown no side-effects, such as inappetence, bleeding, prolapses of abdominal organs, swelling in inguinal region and inability to stand up or walk because of pain. Similar results were achieved by LEDECKÝ et al. (2003). All surgical wounds of bears treated in this study healed "per primam".

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SAŽETAK

Ograđeni prostori i utočišta za zbrinjavanje europskih smeđih medvjeda (*Ursus arctos*) ograničeni su površinom za prihvat napuštenih jedinki. Budući da je smeđi medvjed zaštićena vrsta, valja voditi brigu o broju jedinki njihove populacije. Najbolja kontrola broja jedinki u zatočeništvu je putem kirurškoga zahvata kastracije odnosno orhiektomije mužjaka zbog relativno jednostavne izvedbe zahvata. Orhiektomija četiriju mužjaka obavljena je u općoj anesteziji kombinacijom ketamin i ksilazin hidroklorida primijenjenih intramuskularno. U sva četiri medvjeda orhiektomija je obavljena zatvorenom metodom. U jednoga je primijenjena metoda dva kožna reza usporedno s mošnjičnim šavom, a u tri medvjeda preskrotalna metoda orhiektomije. U svih je primijenjena tehnika tri hemostata prilikom podvezivanja sjemenova užeta, a rane su bile sašivene resorptivnim koncem pojedinačnim čvorastim šavom. Buđenje iz anestezije bilo je uobičajenoga tijeka bez nuspojava. Zahvat je prosječno trajao 54 minute, a opća anestezija 171,5 minuta. Sve kirurške rane zacijelile su „per primam", a oporavak je prošao bez nuspojava.

Ključne riječi: smeđi medvjed, *Ursus arctos*, testis, orhiektomija, kastracija